

Sample Assignment

TOXMAP (<http://toxmap.nlm.nih.gov>)

Adapted from the work of Mr. Robert Jordan, Bath, Maine

Performance Indicator: In this assignment, you will work with a web-based Geographic Information System (GIS) to demonstrate your ability to use mapping to answer some geographic and environmental questions.

The Problem: Chemicals play an important role in our lives and in our world. However, some chemicals are toxic and pose risks to the environment and to people's health. These tasks involve identifying areas of the United States where certain toxic chemicals have been released and analyzing release trends and population data.

Background: Federal law requires facilities in certain industries, which manufacture, process, or use significant amounts of toxic chemicals, to report annually on their releases of these chemicals to the EPA TRI (Toxics Release Inventory) Program (<http://www.epa.gov/tri/>). Superfund sites (<http://www.epa.gov/superfund/index.htm>) are waste sites throughout the United States and its territories that contain substances that are either designated as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act ([CERCLA](#)), or identified as such under other laws.

TOXMAP uses maps of the United States to help users visually explore data from these EPA programs. It shows where these chemicals are released on-site into the air, water, and ground, and identifies the releasing facilities, single year releases, and chemical release trends over time. Maps can also show locations of Superfund sites on the National Priority List (NPL) (<http://www.epa.gov/superfund/sites/npl>), listing all chemical contaminants present at these sites.

The Task: Your task is to use TOXMAP to find and analyze information about the on-site releases (TRI facilities) and/or presence (Superfund site) of specific toxic chemical/s. You will also analyze the chemical releases that have occurred in a specific area of the country. You will demonstrate your skills by answering a series of questions. Before completing this assignment you may find it helpful to go through the TOXMAP tour at <http://toxmap.nlm.nih.gov/toxmap/tour/index.html>.

***Chemical Focus: Cadmium and Cadmium Compounds**

Information sources

EPA: <http://www.epa.gov/ttn/atw/hlthef/cadmium.html>

ATSDR: <http://www.atsdr.cdc.gov/tfacts5.html>

***Physical Properties:**

- Cadmium is a soft silver-white metal that is usually found in combination with other elements; Cadmium compounds range in solubility in water from quite soluble to practically insoluble.
- The chemical symbol for cadmium is Cd and the atomic weight is 112.41 g/mol.
- Most cadmium used in the US today is obtained as a byproduct from smelting zinc, lead, or copper ores.

* See the TOXMAP FAQ "How are TRI chemical trends calculated" to see its limitations and how it handles special cases.

***Health Effects Mentioned on EPA Fact Sheet:**

- Effects on the lung, including bronchiolitis and emphysema, bronchial and pulmonary irritation.
- A single acute exposure to high levels of cadmium can result in long-lasting impairment of lung function.
- Cadmium is considered to have high acute toxicity, based on short-term animal tests in rats.
- Effects on the kidney, liver, lung, bone, immune system, blood, and nervous system.
- Reduction in sperm number and viability in humans.
- Maternal cadmium exposure may result in decreased birth weights.
- Low fetal weight, skeletal malformations, interference with fetal metabolism, and impaired neurological development, via inhalation and oral exposure.
- Decreased reproduction and testicular damage, have been noted following oral exposures.
- EPA considers elemental cadmium to be a probable human carcinogen (cancer-causing agent) and has classified it as a Group B1 carcinogen. Exposure to Cadmium compounds, however, has not been demonstrated to result in cancer in animal ingestion studies.

1. **Where does the TRI and Superfund data used in TOXMAP come from?**
 - a. The Centers for Disease Control (CDC)
 - b. The Department of Health and Human Services (HHS)
 - c. The National Library of Medicine (NLM)
 - d. The Environmental Protection Agency (EPA)
 - e. The Federal Toxin Control Agency

2. **What is the primary use of Cadmium compounds?**
 - a. Pigments
 - b. Electroplating of automotive, aircraft & electronic parts
 - c. Barometers, thermometers, hydrometers
 - d. Batteries
 - e. Production of fire resistant textiles, friction materials (i.e., brake linings), roofing papers, and floor tiles.

3. **How many on-site TRI releases of Cadmium compounds were reported in the United States during 1999?**
 - a. 3
 - b. 75
 - c. 84
 - d. 423
 - e. 517

4. **How many Superfund sites are reported to contain Cadmium compounds in the United States?**
 - a. 0
 - b. 2
 - c. 30
 - d. 226
 - e. 821

5. **What is the name of the TRI facility in the United States that released the most Cadmium compounds on-site in 2002?**
 - a. VICKERY ENVIRONMENTAL INC. (Vickery, OH)
 - b. CLEAN HARBORS GRASSY MOUNTAIN, LLC (Grassy Mountain, UT)
 - c. US ECOLOGY IDAHO INC. (Grand View, ID)
 - d. CHEMICAL WASTE MANAGEMENT INC. (Emelle, AL)
 - e. RED DOG OPERATIONS (Kotzebue, AK)

6. **How many pounds of Cadmium compounds did this plant release on-site in 2002?**
 - a. 2,315,192
 - b. 2,314,956
 - c. 361,049
 - d. 103,630
 - e. 3,946

7. **Which statement best describes how Cadmium compounds on-site releases at this plant varied from 1999 and 2002?**
- a. Cadmium compounds releases dropped every year between 1999 and 2002.
 - b. Cadmium compounds releases fell in 2000 and 2001 and then rose slightly in 2002
 - c. Cadmium compounds releases fell significantly in 2000 then rose slightly again in 2001 and 2002.
 - d. Cadmium compounds releases rose dramatically in 2000 and 2001 and then dropped in 2002
 - e. Cadmium compounds releases remained fairly constant between 1999 and 2002.
8. **Which of the substances below was NOT released on-site from this facility in 2002?**
- a. Benzene
 - b. Copper Compounds
 - c. Lead Compounds
 - d. Methanol
 - e. Nickel Compounds
9. **According to the Bureau of Economic Analysis, what was 2002 per capita personal income in the county where this facility is located?**
- a. Over 35,415 dollars
 - b. Between 28,811 and 35,414 dollars
 - c. Between 25,314 and 28,810 dollars
 - d. Between 22,822 and 25,313 dollars
 - e. Less than 22,822 dollars
10. **How many other facilities in this state also reported on-site releases of Cadmium compounds during 2002?**
- a. 0 Facilities
 - b. 1 Facility
 - c. 2 Facilities
 - d. 3-5 Facilities
 - e. Over 5 Facilities
11. **How many Superfund sites are in this state?**
- a. 0 Sites
 - b. 1 Sites
 - c. 2 Sites
 - d. 3-10 Sites
 - e. Over 10 Sites

12. **Were there any reported on-site releases of Cadmium compounds in Massachusetts during 2000? If so, where was the facility with the largest releases located?**
- No Cadmium compounds on-site releases in Massachusetts.
 - Largest Cadmium compounds on-site releases in DIGHTON, MA
 - Largest Cadmium compounds on-site releases in SOUTH HADLEY, MA
 - Largest Cadmium compounds on-site releases in ATTLEBORO, MA
 - Largest Cadmium compounds on-site releases in SOMERVILLE, MA
13. **Which statement most accurately describes the location of TRI facilities with on-site releases of Cadmium compounds in 2004?**
- The facilities with the large on-site releases are distributed pretty evenly throughout the United States.
 - The facilities are mostly located in New England.
 - The 10 facilities with the largest on-site releases are all located west of the Mississippi River.
 - The two facilities with the largest on-site releases are located in adjoining States.
 - Four of the ten facilities with the largest on-site releases are located in Texas.
14. **How many facilities in Nevada released Cadmium compounds on-site in 1990?**
- Zero
 - 1
 - 18
 - 27
 - 671
15. **Which of the following parts of Nevada had the highest population per square mile in 1990?**
- The Northeast
 - The Southeast
 - In the area around Carson City, Nevada
 - In the area around Eureka, Nevada
 - Along the Utah Border
16. **Which facility in Nevada had the largest total of on-site toxic releases for all years of the TRI program combined?**
- KENNECOTT UTAH COPPER MINE CONCENTRATORS & POWER PLANT
 - IMC CHEMICALS INC.
 - BARRICK GOLDSTRIKE MINES INC.
 - ASARCO INC. MISSION COMPLEX
 - US ECOLOGY NEVADA, INC.
17. **The three TRI chemicals that were released in the largest amounts at this site were :**
- 1) Arsenic compounds, 2) Manganese compounds, 3) Zinc compounds
 - 1) Chlorine, 2) Arsenic compounds, 3) Asbestos
 - 1) Sodium Sulfate (Solution), 2) Arsenic compounds, 3) Ammonia
 - 1) Arsenic compounds, 2) Lead compounds, 3) Manganese compounds
 - 1) Phosphoric Acid, 2) Manganese compounds, 3) Arsenic compounds

18. **Which of the following statements is true about the three facilities in Nevada that had the largest on-site releases of toxins for all years of the TRI program combined?**
- a. All three facilities are located in the same county.
 - b. All three facilities reduced their on-site releases of Arsenic compounds in 2002.
 - c. One facility is involved in mining, one facility produces chemical solvents for the automobile industry, and one facility produces batteries.
 - d. Two of the three facilities are owned by the same company.
 - e. One of the three facilities is located in Nevada's most densely populated county according to the 2000 U.S. Census.
19. **What is the name of the reporting facility (considering all years of the TRI program) that is located in or closest to Eureka, Nevada?**
- a. CORTEZ MINES MILL 2
 - b. EQUATORIAL TONOPAH INC
 - c. BALD MOUNTAIN MINE
 - d. COASTAL CHEM INC
 - e. RUBY HILL MINE
20. **What is produced at this facility?**
- a. Asbestos
 - b. Copper
 - c. Gold Ores
 - d. Iron Ore
 - e. Rubies and other precious gems
21. **Which chemical was most released on-site at this facility (considering all years of the TRI program)?**
- a. Arsenic compounds
 - b. Asbestos
 - c. Cyanide compounds
 - d. Lead compounds
 - e. Nitric Acid
22. **Which statement best describes the trends in the on-site release amounts of Mercury compounds and Nitric Acid at this facility in or near Eureka, Nevada from 2000 to 2002?**
- a. Releases of Mercury compounds and Nitric Acid both decreased.
 - b. Releases of both Mercury compounds and Nitric Acid both increased.
 - c. Releases of Mercury compounds were higher and releases of Nitric acid were lower.
 - d. Releases of Nitric Acid were higher and releases of Mercury compounds were lower.
 - e. A comparison can not be made because these chemicals have not been released at this plant during this time period.

23. **According to the National Center for Health Statistics, what was the female mortality rate (All Causes of Death, Age-Adjusted Death Rate per 100,000 population, 2000-2004) in the county where Eureka, Nevada is located between?**
- a. 738.3 – 768.1
 - b. 798.5 – 832.5
 - c. 1171.1 – 1232.4
 - d. It cannot be determined due to “Sparse Data”
 - e. None of the above
24. **Which of the following statements best describes Superfund sites in Nevada?**
- a. There are no Superfund sites in Nevada.
 - b. Nevada Superfund sites tend to be in the lower-populated counties.
 - c. Nevada has two Superfund sites, both in the western portion of the state.
 - d. Nevada contains more Superfund sites than Puerto Rico.
 - e. Nevada has one Superfund site, which reports presence of Arsenic, Lead and Mercury.
25. **Under what conditions does the EPA (and the state) assign to a Superfund site the status of Deleted from the National Priorities List?**
- a. If at least five years pass and no new contaminants are found.
 - b. When all contaminants have been cleaned up from the site.
 - c. When site cleanup goals have been met and no further response is necessary at the site.
 - d. Once site cleanup has begun.
 - e. Superfund sites are not deleted from the National Priorities List.

Challenge question:

How many TRI facilities located in Nevada, Utah, or Arizona released over 10,000 pounds on-site of Cadmium compounds cumulatively between 2000-2004? (Hint: try the "Set Region" tab.)

- a. Zero
- b. 13
- c. 15
- d. 16
- e. 60

Name: _____

Student ID: _____

Teacher _____

Period : _____

Score: _____ of 25

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Challenge question: _____